PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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'05 JUL -7 13:30

PCT

WRITTEN OPINION OF THE INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY
(PCT Rule 66)

Date of mailing *(day/month/year)*	- 1 JUL 2005
Applicant's or agent's file reference: NANY/20401156/kc/MT	REPLY DUE within **TWO MONTHS** from the above date of mailing

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SG2004/000210	13 July 2004	25 July 2003

International Patent Classification (IPC) or both national classification and IPC
Int. Cl. [7] H01J 37/04, H05H 1/46

Applicant
NANYANG TECHNOLOGICAL UNIVERSITY et al

1. [X] The written opinion established by the International Searching Authority:
   [X] is [ ] is not
   considered to be a written opinion of the International Preliminary Examining Authority.

2. This **second** (second, etc.) opinion contains indications relating to the following items:

[X]	Box No. I	Basis of the opinion
[ ]	Box No. II	Priority
[ ]	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
[ ]	Box No. IV	Lack of unity of invention
[X]	Box No. V	Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
[ ]	Box No. VI	Certain documents cited
[ ]	Box No. VII	Certain defects in the international application
[ ]	Box No. VIII	Certain observations on the international application

3. The applicant is hereby **invited to reply** to this opinion.

When? See the **Reply Due** date indicated above. However, the Australian Patent Office will not establish the Report before the earlier of (i) a response being filed, or (ii) one month before the **Final Date** by which the international preliminary examination report must be established. The Report will take into account any response (including amendments) filed before the Report is established.
If no response is filed by 1 month before the Final Date, the international preliminary examination report will be established on the basis of this opinion.
Applicants wishing to have the benefit of a further opinion (if needed) before the report is established should ensure that a response is filed at least **3 months before the Final Date** by which the international preliminary examination report must be established.

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3.
For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4*bis*.
For an informal communication with the examiner, see Rule 66.6.

4. The **FINAL DATE** by which the international preliminary report on patentability (Chapter II of the PCT) must be established according to Rule 69.2 is: 25 November 2005

Name and mailing address of the IPEA/AU	Authorized Officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	**BAYER MITROVIC** Telephone No. (02) 6283 2164

INDEX ✓ ✓
DUE DATE 1-9-05 ✓ ✓
REMINDER 1-8-05 ✓ ✓

WRITTEN OPINION OF THE
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

International application No.
PCT/SG2004/000210

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion is based on a translation from the original language into the following language , which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1 (b))

☐ publication of the international application (under Rule 12.4)

☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the elements of the international application, this opinion has been established on the basis of (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed."*):

☒ the international application as originally filed/furnished

☐ the description: pages , as originally filed/furnished
pages , received by this Authority on with the letter of
pages , received by this Authority on with the letter of

☐ the claims: pages , as originally filed/furnished
pages , as amended (together with any statement) under Article 19,
pages , received by this Authority on with the letter of
pages , received by this Authority on with the letter of

☐ the drawings: pages , as originally filed/furnished
pages , received by this Authority on with the letter of
pages , received by this Authority on with the letter of

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages
☐ the claims, Nos.
☐ the drawings, sheets/figs
☐ the sequence listing (*specify*):
☐ any table(s) related to the sequence listing (*specify*):

4. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages
☐ the claims, Nos.
☐ the drawings, sheets/figs
☐ the sequence listing (*specify*):
☐ any table(s) related to the sequence listing (*specify*):

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Box No. V **Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	2, 4-14, 16, 17, 19, 23	YES
	Claims	1, 3, 15, 18, 20, 21, 22	NO
Inventive step (IS)	Claims	8, 11, 14, 17	YES
	Claims	1-7, 9, 10, 12, 13, 15, 16, 18-23	NO
Industrial applicability (IA)	Claims	1-23	YES
	Claims		NO

2. Citations and explanations:

The following documents identified in the International Search Report have been considered for the purposes of this report:

D1: US 6501447
D2: GANTER ET AL:" EFFICIENCY OF AC PLASMA DISPLAY PANELS FROM DIAGNOSTICS AND MODELS", Appl.Surf.Sci.vol.192,no.1, pp.299-308 (2002) (preprint from www.iquesta.com/articles/plasma.PDF)

Document D1 discloses a plasma display panel having first and second set of parallel electrodes perpendicularly arranged to each other and driven by radiofrequency currents. Frequencies used are from 200-300kHz on the data and scanning electrodes, and hundreds of MHz on the RF electrodes (column 2 lines 8-47, column 4 lines 36-46). Although the data and scanning electrodes are not designated as "radiofrequency" electrodes (in order to distinguish them), they are still operated in the radiofrequency spectrum (hundreds of kHz). A uniform discharge is generated (column 3 lines 8-37). Electrodes may be covered by dielectric sheets (column 2 lines 8-47).

Document D2 discloses a matrix type of AC plasma panel using perpendicular electrodes covered with dielectric layers (1st paragraph of section VI). A square wave voltage in the 100kHz range is applied between the line and the column electrodes and the discharge is established in the gap between the electrodes filled with an inert gas mixture such as Ne-Xe (1st paragraph of section I). Again, a frequency of around 100kHz is still regarded to be in the radiofrequency spectrum.

CLAIMS 1-23 NOVELTY AND INVENTIVE STEP

From above observations it is concluded that:
The invention defined in 1, 3, 15, 18, 20, 21, and 22 is not novel when independently compared with above documents which disclose all the essential features of the invention claimed.
Furthermore, independent claims 6, 9 and 12 as well as appended claims 2, 4, 5, 7, 10, 13, 16, 19 and 23 relate to parameters or structures that are merely matters of design choice when the general technical knowledge about the state of the art is used and hence they cannot contribute to patentable invention. Therefore these claims lack an inventive step.
Claims 8, 11, 14 and 17 meet the criteria set out in PCT Articles 33(2) and 33(3) with regard to the requirement of Novelty and Inventive Step, respectively, because the prior art does not disclose or obviously suggest to a person skilled in the art a claimed perpendicular configuration of driving electrodes operated at 300-1000kHz where oscillating current exhibit substantially no phase difference so to produce a uniform discharge.

CLAIMS 1-23 INDUSTRIAL APPLICABILITY

Invention defined in claims 1-22 is industrially applicable.

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: V

Examiner's reply to applicants rebuttal

Objections raised in the 1st Written Opinion are maintained. The reasons are as follows.

1. Applicant contends that a "current sheet" is different from an "electrode". However "current sheet" is a mathematical abstraction often used by theorists in variety of areas of electrical engineering such as for example Engineering Electromagnetics, Electric Circuit Theory, Antenna Design, etc. In engineering practice each "current sheet" conceived by a designer will have to be made in the workshop, and eventually will end up as a piece of hardware, usually in the form of an array of wires, cables, conductors, antenna rods, electrodes, or as a metallic plate, or so. Therefore, the phrase "current sheet" is construed in a broad meaning as being more or less equal to any or at least some of these practical realizations. In addition, applicant did not define characterising features of the integer "current sheet" so that it is construed in the broadest possible way.

2. Applicant contends an "electrode" is a different concept from an "antenna". I agree that the difference exists between electrodes and antennas. This difference is, in fact, made on the basis of the ratio between the wavelength and the characteristic dimensions of the metallic and dielectric objects that constitute the electromagnetic system.

If the lengths or characteristic size of conductors or other material objects are smaller or much smaller than the wavelength, then the approximation of electric circuit theory applies and it is more appropriate to talk about electrodes, etc. This is so-called near-field approximation. However, if the characteristic size of the wires is much larger than the wavelength, then it is appropriate to talk about antennas and in which case far-field or radiation field is of main relevance. Circuit approximation is invalid and the Maxwell equations must be used.

Now, when claim 1 is considered, it is clear that no wavelength has been defined, except that it is in RF region of the spectrum. Because no wavelength has been defined the feature of "current sheet" is construed broadly as both antenna and electrode (it could be any of them). Furthermore, claim 4 defines that frequency is 300-1000kHz and simple calculation shows that wavelength of these frequencies is between 300m and 1km. So, the question may be asked of what kind of plasma deposition chamber would have characteristic dimensions of over 300m?!

For these reasons the electromagnetic driving system of the chamber of the claimed invention must be described as a system of electrodes, or it you prefer to say, as a circuit, or system of conductors, rather than as an antenna or system of antennas. More precisely it is a lumped parameter RF circuit and not the antenna. All known plasma processing reactors can fit into an average laboratory so that the circuit approximation will always apply when designing the system of driving electrodes.

It should be said here that the term "electrode" is construed broadly as an AC electrode or, better to say, an RF electrode, which does not necessarily need to be in a conductive contact with other system components . An AC or RF electrode can be capacitively or inductively coupled with the rest of the system and does not need to touch anything. For example a coil which surrounds a glass chamber filled with the ionised gas but without touching the external surface can also be called electrode.

Examiner admits that it is possible to reserve the word "electrode" only for conductive contact (with metal or ionised gas). Then the phrase "RF circuit" can be used for capacitive and inductive coupling without the conductive contact. If this is the intention, than it should be clearly defined within the claims.